
Methods for Preserving Audiovisual Data

Cooperatively Utilizing Digital Fingerprints & Watermarks



A Time Warner Company

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NEW LINE CINEMA

HBO



TIME WARNER CABLE



CNN

People

tbs very funny



Sports Illustrated

CASTLE ROCK ENTERTAINMENT



AOL Instant Messenger

Time Warner Book Group

COURT TV

AOL FOR BROADBAND

InStyle

Netscape

CNN INTERNATIONAL

money

icq

TIME

CARTOON NETWORK

FORTUNE

TNT WE KNOW DRAMA

People EN ESPAÑOL

AMERICA Online

Teen People

Southern Living

Bravo

CompuServe

HBO Latino

Road Runner High Speed Online

REAL SIMPLE

NY 1

Entertainment WEEKLY



Cooking Light



COMERANG

CNN EN ESPAÑOL

FIELD STREAM

moviefone



BUSINESS 2.0



Sunset LIFE IN THE WEST

CNNfn the financial network

WARNER BOOKS

AOL INTERNATIONAL

ESSENCE

ipc media

TURNER CLASSIC MOVIES TCM

AOLmusic



MAPQUEST.COM

cine max

digitalphone



CNN HeadlineNews

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Overview

- Despite the proliferation of video on the Web, the availability of quality, consistent metadata remains elusive
 - Standards, related implementation issues cause inconsistency
 - Syndication and the repurposing of traditional linear content feeds for the Web complicates metadata survivability
 - Transcoding, transcribing, and substitution of container formats can all affect metadata integrity and survivability
 - A significant amount of content is (re)published by publishers unaffiliated with content owners or distributors causes metadata unpredictability
- Lack of quality metadata has several consequences
 - Suboptimal search results
 - Complicates enforcement of usage rights
 - Affects ability to reliably measure and monetize content usage
- Digital watermarking and fingerprinting can help maintain metadata integrity through production, distribution, and consumption chains



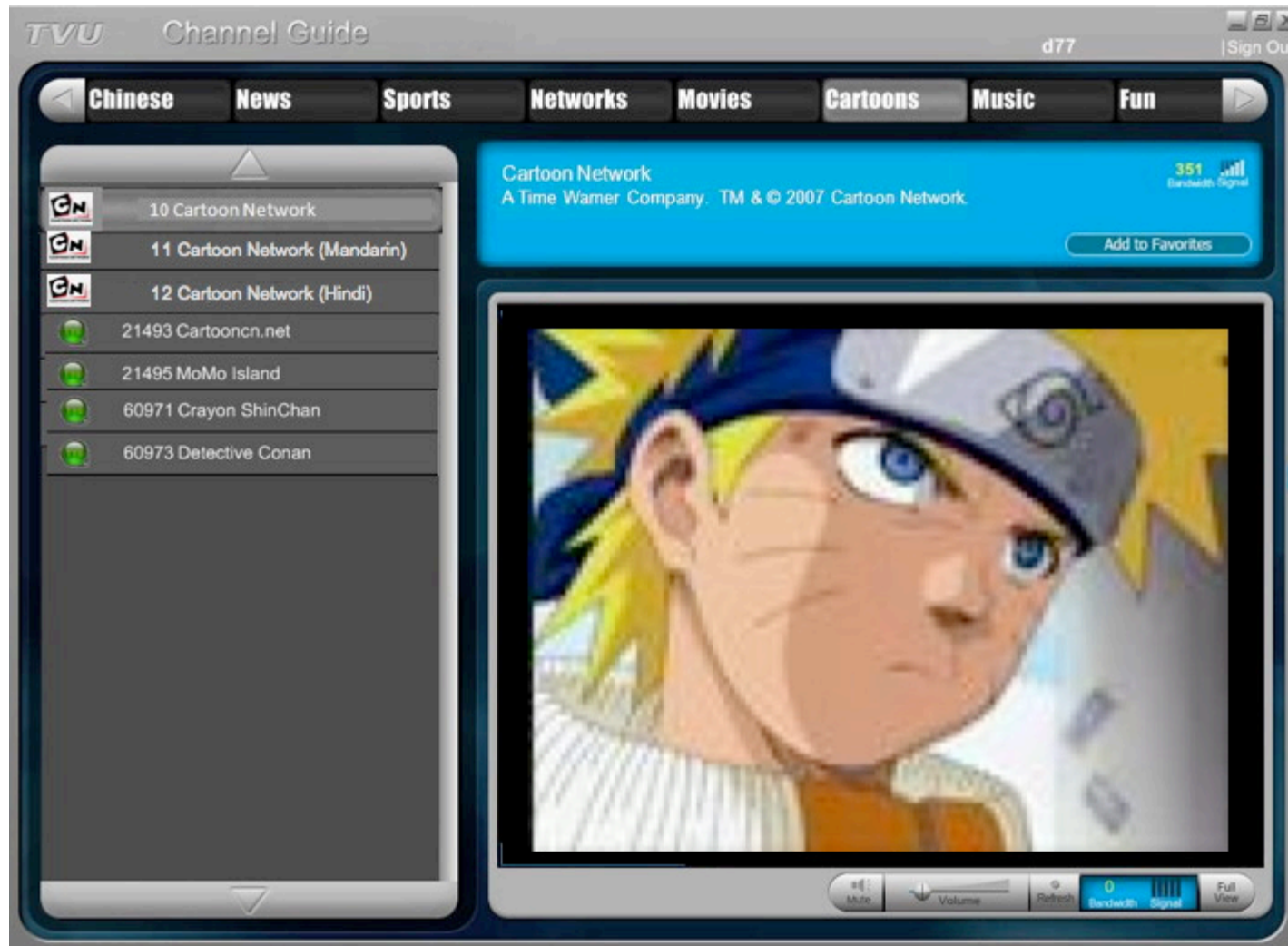
CNN.com Hosted Video: Rich, Accurate Metadata

The screenshot shows a web browser window displaying the CNN.com video player. The browser's address bar shows the URL <http://www.cnn.com/video/>. The page features a navigation bar with links for "Live Video", "Podcasts", and "CNN Radio". The main content area displays a video player for "The evangelical vote" (4:03), featuring Evangelist Franklin Graham. The video player includes a progress bar and a play button. Below the video player, the metadata is displayed, including the source (CNN) and the date added (December 12, 2007). A "NEXT UP" section on the right lists related videos: "The evangelical vote" (4:03), "CIA chief under the hot seat" (4:16), and "Homes washed away" (3:17). The bottom of the page features a "TOP STORIES" section with a search bar and a row of video thumbnails with titles and durations: "Drastic Fantastic: KT Tunstall" (5:48), "NJ state troopers under fire" (1:23), "KBR rape allegations" (2:08), "Crack cocaine and the courts" (5:34), "Burglar steals family dog" (1:15), and "Clinton's lead dries up in NH" (3:04). Each thumbnail includes a "playlist" button.

Loading "http://www.cnn.com/video/", completed 52 of 53 items



Syndicated Linear Video: Less Metadata



User Re-encoded Linear Content on the Web: Potentially Unpredictable Metadata

The screenshot shows a YouTube video player with the following details:

- Video Title:** Cspan: Thomas Beaumont re: Ron Paul, Huckabeees
- Channel:** unconscious767 (Joined 11 months ago, 47 Videos)
- Video Description:** excerpts from: Cspan Washington Journal, Dec. 09, '07 Thomas Beaumont, Des Moines Register, Chief Political Reporter, offers a look at what the candidates are doing in Iowa, less than a month away from the Iowa caucuses. entire program (requires realplayer): <http://tinyurl.com/38osew> (less) Added: December 09, 2007 Category: News & Politics Tags: ron paul cspan washington journal mike huckabee thomas beaumont demoines register
- URL:** <http://youtube.com/watch?v=wOC-zMrLG-Y>
- Embed Code:** `<object width="425" height="355"><param name="movie" value="h`
- Video Player:** Shows a man speaking with a "LIVE" indicator and a "Call from KANSAS" banner.
- Engagement:** Rate: 4 stars (89 ratings), Views: 3,506, Comments: 39, Favorited: 15 times, Honors: 0, Links: 5.
- Comments & Responses:** Shows a "Show" dropdown set to "average (-5 or better)" and "Help" link.



Digital Watermarks and Fingerprints Defined

- Digital Watermarking technologies enable the addition of a hidden message to an audiovisual file
 - Current digital watermarking technologies have the ability to survive common transformations such as re-encoding, sub-sampling, and cropping of the original media files
 - There are tradeoffs and relationships between watermark transparency, recoverability, survivability, and payload size
 - Practical payload sizes are typically 3-10 bits/second
 - Many vendors
- Digital Fingerprinting is the calculation of a unique “fingerprint” of a segment of content
 - A segment is identified by calculating a fingerprint of the content and performing a comparison against a database of known fingerprints
 - Many vendors



Possible Applications of Digital Watermarks and Fingerprints

- Possible uses of these technologies are many. Examples include:
 - Facilitation of usage measurement through the embedding of a unique ID analogous to a UPC code
 - Assistance in the enforcement of various usage rules through the embedding of usage flags
 - Identifying when and where an asset transited various distribution points through the embedding of forensic watermarks
- Improved monetization opportunities could be possible



Challenges in Broadly Implementing Digital Watermark Technologies

- Effective digital watermark payload sizes are small relative to ideal metadata payloads
- Unpredictable results occur when multiple watermark technologies are applied to a content segment
- Fingerprinting can augment efforts to identify content, but
 - Can be computationally more expensive than watermark detection
 - Doesn't enable certain metadata to be “self identifying”

Technical constraints will likely require industry cooperation to meaningfully leverage digital watermark and fingerprint technologies to preserve metadata

